

I.

Executive Summary

- a. **Title.**—Seasonal and annual abundance of aquatic piscivores, Sacramento squawfish *Ptychocheilus grandis* and striped bass *Morone saxatilis*, near the Red Bluff Diversion Dam, Sacramento River, California
- Applicant.**—U. S. Fish and Wildlife Service, Northern Central Valley Fish and Wildlife Office, Red Bluff, California., 10950 Tyler Road, Red Bluff, California 96080. Phone: (916)527-3043, Fax: (916)529-0292, email: jim_smith@mail.fws.gov.
- b. **Project Description.**—The goal of this project is to determine if man-made structures at Red Bluff Diversion Dam (RBDD) can be constructed and operated in a manner that creates no new local attraction for aquatic piscivores and no increase in predation on downstream migrating juvenile chinook salmon *Oncorhynchus tshawytscha*. This will be accomplished by monitoring changes in predator abundance, particularly Sacramento squawfish *Ptychocheilus grandis* (squawfish) and striped bass *Morone saxatilis*, in the immediate vicinity of the RBDD and Research Pumping Plant (RPP). If necessary, recommendations for reducing predation on juvenile salmon will be made. Stressors, such as migrational barriers which delay squawfish and striped bass and create ambush habitats for these predators, have negative effects on populations of downstream migrating salmonids. Priority species effected by this project include: winter chinook, spring chinook, late fall chinook and green sturgeon. Specific objectives are to: 1) estimate seasonal relative abundance of aquatic predators in the immediate vicinity of RBDD, including the RPP trash racks, bypass outfall structure, and an undeveloped site downstream of the dam for characterizing natural river conditions; 2) determine squawfish and striped bass food habits to evaluate predation on migrating juvenile salmonids; and 3) gain insight into squawfish and striped bass life histories by tracking movements and population age structure and growth.
- The primary benefits of this project are precise indices of squawfish and striped bass abundance in the vicinity of the man-made structures at RBDD. It will allow evaluation of the effectiveness of operational and structural improvements at RBDD and how they effect abundance of squawfish and striped bass near the structure. It will also contribute to our knowledge of squawfish life history, a native fish of the Sacramento River. This proposal is for the continuation of an ongoing study plan to evaluate predator abundance around the RBDD and the associated man-made structures in that area.
- c. **Approach.**—The study area will be stratified into six specific sampling transects. Five of the transects will run adjacent to the man-made structures around and including the dam. These five sampling transects will include the west side of the dam, the east side of the dam, the bypass outfall structure, the RPP trash racks, and sheet-piling wall directly downstream of the RPP trash racks. The sixth transect will be used as a control, and will be located at a natural free flowing site approximately one-mile downstream of the dam. Standardized sampling of these six transects will allow comparisons between the man-made structures around and including the dam, and between man-made and a natural river environment. The abundance indices will provide researchers and managers the ability to track population trends over time.
- Transects will be sampled weekly. Squawfish and striped bass will be collected using a combination of angling and electro-fishing. These two sampling techniques have proven to be effective and complementary in that electro-fishing has been effective in shallow shoreline areas and angling in deep swift areas. A Smith-Root electro-fishing boat, equipped with smooth mode shocking abilities to cause less harm to fish, will be employed. fork lengths (mm), and wet weights (g) will be recorded from all squawfish and striped bass captured.
- Tasks.**—This project has been funded by the Reclamation since 1994 as part of the evaluation of the RPP. The current Phase II portion of this project has reduced sampling effort to one day per month. With additional funding (Task 1) sampling would expanded to weekly with increased effort at night. U. S. Bureau of Reclamation (Reclamation) funding will likely cease after fiscal year 1998 when in-river evaluations of the RPP are completed. Task 2 would include the continuation of this monitoring to FY '99 and '00.

DWR WAPRONISE

Schedule.—Field work for the pilot program began in July 1994 and extended through summer 1995. Field work has been continuous since 1994 and a report will be completed summer of 1997.

Report Schedule.—Reports will be submitted annually. Quarterly reports are currently prepared for the Reclamation and can be continued if desired.

- d. **Justification for Project Funding by CALFED.**—The RBDD site is below the spawning areas of priority species: winter chinook, main stem spring chinook, late-fall chinook and steelhead trout. Green sturgeon and splittail are also in the RBDD area. Operational and structural changes at RBDD have/and will be developed as part of ecosystem restoration programs. These fixes should include features that do not create new attraction for aquatic predators. Evaluation of the effectiveness of these fixes in not creating new predator habitat is vital to the success of fish restoration programs. Sampling at this site would also benefit other programs involved in fish restoration. Squawfish and striped bass studies at RBDD are consistent with recommendation of other ecosystem restoration programs, such as: Central Valley Project Improvement Act (CVPIA), Red Bluff Diversion Dam CVPIA (3406 [b] 10) actions and planning process, Anadromous Fisheries Restoration Program (AFRP), and Red Bluff Research Pumping Plant Evaluations .

- e. **Budget Costs.**—Project costs for Task 1, which is an expansion of the existing Reclamation evaluation of the Research Pumping Plant project at RBDD, which extends through FY '98, are \$288,000; and annual costs for Task 2, which continues a full scale project for FY '99 and '00, \$380,000 per year. No major capital expenditures will be required since the project would use existing boats and electro-fishing gear. This project is envisioned and multiyear and would continue as long as the data is needed by managers and researchers working on restoration projects in the basin.

Third Party Impacts.—No third party impacts will occur during this project.

- f. **Applicant Qualifications.**—The Northern Central Valley Fish and Wildlife Office (NCVFWO) was established in 1978 as part of the U.S. Fish and Wildlife Service's (Service) responsibility to facilitate restoration of Pacific salmonids. The construction and operation of dams and water diversion projects and the subsequent degradation and loss of habitat have been the primary contributors to the decline in all anadromous salmonid stocks in the upper Sacramento River. Specific goals of the NCVFWO are to: 1) Stabilize or increase the runs of anadromous salmonids in the Sacramento River system, 2) Improve the effectiveness of federal fish propagation facilities in California and Nevada, 3) Protect and restore the productivity of natural habitats in the Sacramento River system, and 4) Continue development of information and strategies for protecting the natural habitats of the Sacramento River system as migration routes, spawning areas, and nursery areas for anadromous salmonids. The staff consists of 30 biologists and support staff who have working experience in the upper Sacramento River.

- g. **Monitoring and Data Evaluation.**—This is a monitoring project whose data will be used in a variety of management and research efforts. Data evaluation and peer review are critical to the success of this project. Primary project review will occur within the Service, Reclamation, IEP and California Department of Fish and Game. This data is integrated into the RPP evaluation and IEP programs.

- h. **Local Support/Coordination with other Programs/Compatibility with CALFED objectives.**—Sampling at the RBDD benefits numerous restoration programs, coordinating and integrating data for the RPP, IEP, CAMP and AFRP programs. RBDD sampling is supported by the Salmon Project Work Team of the IEP. Main stem juvenile monitoring at RBDD have been identified in all current restoration planning documents: *Upper Sacramento River Fisheries and Riparian Habitat Management Plan*, *Central Valley Salmon and Steelhead Restoration and Enhancement Plan*, *Restoring Central Valley Streams: A Plan for Action*, and *Steelhead Restoration and Management Plan for California*, and *Working Paper on restoration needs: habitat restoration actions to double natural production of anadromous fish in the Central Valley of California. Volume 1, 2 and 3.*

**SEASONAL AND ANNUAL ABUNDANCE OF AQUATIC PISCIVORES,
SACRAMENTO SQUAWFISH *Ptychocheilus grandis* and STRIPED BASS *Morone
saxatilis*, NEAR THE RED BLUFF DIVERSION DAM, SACRAMENTO RIVER,
CALIFORNIA**

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Group 3; Other Services

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III.

Project Description

- a. **Project Description and Approach.**—The goal of this project is to determine if man-made structures at Red Bluff Diversion Dam (RBDD) can be constructed and operated in a manner that creates no new local attraction for aquatic piscivores and no increase in predation on downstream migrating juvenile chinook salmon *Oncorhynchus tshawytscha*. This will be accomplished by monitoring changes in predator abundance, particularly Sacramento squawfish *Ptychocheilus grandis* (squawfish) and striped bass *Morone saxatilis*, in the immediate vicinity of the RBDD and Research Pumping Plant (RPP). If necessary, recommendations for reducing predation on juvenile salmon will be made. Stressors, such as migrational barriers which delay squawfish and striped bass and create ambush habitats for these predators, have negative effects on populations of downstream migrating salmonids. Priority species effected by this project include: winter chinook, spring chinook, late fall chinook and green sturgeon. Specific objectives are to: 1) estimate seasonal relative abundance of aquatic predators in the immediate vicinity of RBDD, including the RPP trash racks, bypass outfall structure, and an undeveloped site downstream of the dam for characterizing natural river conditions; 2) determine squawfish and striped bass food habits to evaluate predation on migrating juvenile salmonids; and 3) gain insight into squawfish and striped bass life histories by tracking movements and population age structure and growth.

The primary benefits of this project are precise indices of squawfish and striped bass abundance in the vicinity of the man-made structures at RBDD. It will allow evaluation of the effectiveness of operational and structural improvements at RBDD and how they effect abundance of squawfish and striped bass near the structure. It will also contribute to our knowledge of squawfish life history, a native fish of the Sacramento River. This proposal is for the continuation of an ongoing study plan to evaluate predator abundance around the RBDD, RPP and associated man-made structures in that area.

- b. **Location and/or Geographic Boundaries of Project.**—The RBDD is located in the Sacramento River at river kilometer 388 (river mile 243) about 3 kilometers southeast of the city of Red Bluff, Tehama County. It was completed in 1964, and began operation in 1966. The purpose of the dam is to divert water into the Tehama-Colusa and Corning Canal system, for agriculture and wildlife refuges. The dam consists of eleven moveable gates which can be raised or lowered to impound and divert river flows into the canal.
- c. **Expected Benefits.**—Continuing this study over an extended period of time will provide and indication of trends in predator abundance corresponding to varying operational scenarios of the dam and RPP (e.g. gates in and out, pumps running and not running) as well as effects of varying environmental conditions such as river flows, water temperature, and adult salmon run size. Understanding how these factors effect predator populations and behavior around the dam may allow us to implement operational scenarios which will minimize predatory impacts on priority species.

Priority species which will benefit from an increased knowledge of predator prey interactions at the dam include all four runs of chinook salmon, steelhead trout, and green sturgeon, all of which have juveniles passing the dam throughout the year. A secondary benefit of this study is that it will augment and enhance an existing squawfish radio telemetry study designed to track movements in the same study area. Having these two studies active concurrently will be to the

benefit of each and result in a better understanding of squawfish behavior.

All current restoration planning efforts support RBDD squawfish and striped bass studies: Upper Sacramento River Fisheries and Riparian Habitat Management Plan (Resources Agency 1989), Central Valley Salmon and Steelhead Restoration and Enhancement Plan (Reynolds et al. 1990), Restoring Central Valley Streams: A Plan for Action (Reynolds et al. 1993), Anadromous Fish Restoration Plan (AFRP; U. S. Fish and Wildlife Service 1995), and Steelhead Restoration and Management Plan for California (McEwan and Jackson 1996). It is consistent with recommendation of other ecosystem restoration programs, such as: Central Valley Project Improvement Act (CVPIA), Red Bluff Diversion Dam CVPIA (3406 [b] 10) actions and planning process, Anadromous Fisheries Restoration Program (AFRP) and Red Bluff Research Pumping Plant Evaluations .

- d. **Background and Biological /Technical Justification:** As previously stated this is a proposal to expand and continue studies of abundance, food habits, and life history of Sacramento squawfish and striped bass near the RPP intake structure. The original purpose was to determine if the pumping plant could be constructed and operated in a manner that created no new local attraction for fish predators and no increase in predation on downstream migrating juvenile chinook salmon. Previous data provides an excellent head start with over 700 squawfish and 80 striped bass already tagged and released into the study area. We also have a limited stomach contents analysis and a age and growth data.

Fish ladders at RBDD are inefficient at passing migrating adult salmon. This results in significant delays and blockage of upstream migrating chinook salmon and steelhead. Squawfish and striped bass are also delayed and blocked at the dam. This is most apparent in the spring when squawfish and striped bass are extremely abundant below RBDD. This accumulation may be due to blockage of squawfish during their spawning migration.

A cause of mortality in juvenile chinook salmon is from the dysfunctional predator-prey relation created by RBDD—largely from the squawfish and striped bass that accumulate below the dam. The piscivorous nature of squawfish and striped bass, as well as their preference for salmonids, is well documented (Vondracek and Moyle 1982, 1983); however, they have not been systematically studied immediately below RBDD (Garcia 1989). The squawfish is a native species that co-evolved in the river with chinook salmon and steelhead. In the natural free flowing river setting, the predator-prey relationship between the squawfish and the native salmonids is intact and has no significant effect on salmonid populations (Brown and Moyle 1981). Whereas, man-made structures can provide increased feeding and ambush settings creating and unnatural advantage for predators. Other piscivores present below RBDD beside squawfish and striped bass include rainbow/steelhead trout *Oncorhynchus mykiss*, and American shad *Alosa sapidissima* as well as numerous bird species.

In October 1983, the U. S. Bureau of Reclamation (Reclamation), Service, California Department of Fish and Game (CDFG), NMFS and California Department of Water Resources initiated a five-year Fish Passage Action Program to develop methods to improve upstream and downstream passage at RBDD. The program identified numerous problems at RBDD in which some, but not all, have been addressed. For example, since 1987 the Reclamation has raised the RBDD gates during a significant portion of the non-irrigation season, allowing free passage of adults during that period. Raising the RBDD gates during the non-irrigation season dramatically improves upstream fish passage (Northern Central Valley Fishery Resource Office, USFWS, Red Bluff, California, unpublished data).

For 20 years the RBDD gates remained closed year-round, until winter of 1986 when the gates were raised during the nonirrigating season to improve upstream fish passage. During periods when the gates are raised at RBDD there is still need for irrigation water. To supply this water, the Reclamation is investigating the use of fish friendly pumps at the RPP. This project has been funded by the Reclamation since 1994 as part of the evaluation of the RPP. The current Phase II portion of RPP squawfish and striped bass studies have reduced predator sampling effort to one day per month. With additional funding (Task 1) sampling would be expanded to weekly with increased effort at night. Reclamation funding will likely cease after fiscal year 1998 when in-river evaluations of the RPP are complete. Task 2 would fund the continuation of this monitoring to FY '99 and '00. No other alternatives exist for gathering information about squawfish and striped bass in the upper Sacramento River and how these piscivores might be effecting salmonid production around man-made structures.

- e. **Proposed Scope of Work.**—The study area will be stratified into six specific sampling transects. Five of the transects will run adjacent to the man-made structures around and including the dam. These five sampling transects will include the west side of the dam, the east side of the dam, the bypass outfall structure, the RPP trash racks, and sheet-piling wall directly downstream of the RPP trash racks. The sixth transect will be used as a control, and will be located at a natural free flowing site approximately one-mile downstream of the dam. Standardized sampling of these six transects will allow comparisons between the man-made structures around and including the dam, and between man-made and a natural river environment. The abundance indices will provide researchers and managers the ability to track population trends over time.

Transects will be sampled weekly. Squawfish and striped bass will be collected using a combination of angling and electro-fishing. These two sampling techniques have proven to be effective and complementary in that electro-fishing has been effective in shallow shoreline areas and angling in deep swift areas. A Smith-Root electro-fishing boat, equipped with Smooth Mode Shocking abilities to cause less harm to fish, will be employed. Fork lengths (mm), and wet weights (g) will be recorded from all squawfish and striped bass captured.

Analysis of Abundance.—Healthy, uninjured squawfish and striped bass will be released with a numbered Floy® anchor tag to allow individual identification. Subsequently, all squawfish and striped bass caught will be examined to track movements.

Relative abundance will be estimated from catch data of squawfish and striped bass and expressed as catch per hour per transect. The hypothesis that sample sites have equal fish densities will be tested using a nonparametric Tukey's HSD test. The hypothesis that temporal strata have equal fish densities will be tested using a Wilcoxon paired-sample test.

Predation analysis.—To ascertain predation frequency on salmonids, stomach contents of striped bass and squawfish will be analyzed. A stomach pumping technique, which does not harm the fish, will be used to collect all stomach contents from target species. Contents will be preserved in a 10% formalin solution and brought back to the lab where food items will be identified to order, except for fish which will be identified to species, when possible. Data will be presented as frequency of occurrence and percent by wet weight.

Tasks.—This project has been funded by the Reclamation since 1994 as part of the evaluation of the RPP. The current Phase II portion of this project has reduced sampling effort to one day per month. With additional funding (Task 1) sampling would be expanded to weekly with increased effort at night. Reclamation funding will likely cease after fiscal year 1998 when in-river evaluations of the RPP are complete. Task 2 would fund the continuation of this monitoring to FY '99 and '00.

Addressing Objective 1.—Predator abundance at RBDD is of particular interest. Abundance associated with season and water-year type, as well as population trends will be discussed. Increases in predator abundance associated with the RPP will be important in assessing indirect plant impacts to salmon populations. Trends in abundance after RBDD passage issues are addressed will be extremely beneficial in assessing the success of programs. Establishing baselines before restoration occurs will provide a clearer picture of piscivore abundance trends.

Addressing Objectives 2.—Estimates of juvenile salmon consumed will be evaluated by using estimates of predator populations and numbers of salmon eaten per fish. Combining this information with estimates of numbers of outmigrating juveniles (also being collected by this office), will yield an estimate of predator effects.

Addressing Objectives 3.—Although it is unlikely changes in growth rate or age structure of the predator populations will occur in this short time frame, these data will provide a valuable baseline for these populations. In the event differences are discernable, an increase in predator growth rate would be interpreted as a greater availability of prey, either due to increases in abundance or susceptibility. Likewise, changes in age structure of the population will be interpreted as either an expanding or declining population, most likely due to changes in either habitat or food availability. GSI information will confirm population fluxes due strictly to spawning.

Predator abundance, stomach analysis, and movement data will be combined with estimates of juvenile abundance (from other concurrent study at RBDD) will provide an assessment of the effects of predators on juvenile salmon at the RPP. Recommendations will be provided to reduce predator effects.

Schedule.—Field work for the pilot program began in July 1994 and extended through summer 1995. Analyses for the pilot year and a progress report will be available summer of 1997. Work will be continuous through FY '98, '99 and '00.

Report Schedule.—Reports will be submitted in December '98, '99 and '00. Quarterly reports are currently provided to the Reclamation and Interagency Technical Team (see below) that provides peer review to the RPP project. The quarterly reports could be continued if considered necessary.

- f. **Monitoring and Data Evaluation.**—Data evaluation and peer review are critical to the success of this project. Primary project review will occur within the Service, Reclamation and CDFG. This data is integrated into the RPP program.

Quarterly reports are currently reviewed by an Interagency Technical Team which consists of Reclamation, NMFS, CDFG, Service and stakeholders. When in-river-RPP evaluations are completed in 1999, monitoring data will be circulated to agency personnel and stakeholders in a manner consistent with IEP and AFRP.

- g. **Implementability.**—The RBDD monitoring project complies with all laws and regulations. It is included in the Service's Endangered Species section 10 permit for the directed take of winter chinook and the CDFG MOA on Service sampling in the Sacramento River and its tributaries. CVPIA activities will be covered NEPA documentation with the completion of the Programmatic Environmental Impact Statement currently in preparation which should be completed soon.

Outreach.—An outreach opportunity exists by coordinating field activities with the Sacramento River Discovery Center. This would provide educational opportunities between a CALFED sponsored program and local school districts. To date, high-school students from the Center have worked with biologists on this project and have produced written reports of their activities. The project has also provided educational demonstrations for elementary aged students.

References

- Brown, L. R. and P. B. Moyle. 1981. The impact of squawfish on salmonid populations: A review. *North American Journal of Fisheries Management*. 1:104-111.
- Resources Agency. 1989. Upper Sacramento River Fisheries and Riparian Habitat Management Plan. Prepared for the Resources Agency by an Advisory Council established by SB 1086, authored by Senator Jim Nielsen. 158 pp.
- Reynolds, F. L., T. J. Mills, and J. Schuler. 1990. Central Valley Salmon and Steelhead Restoration and Enhancement Plan. California Department of Fish and Game, Inland Fisheries Division. 115 pp.
- Reynolds, F. L., T. J. Mills, R. Benthin, and A. Low. 1993. Restoring Central Valley Streams: A Plan for Action. California Department of Fish and Game, Inland Fisheries Division.
- McEwan, Dennis, and Terry A. Jackson. 1996. Steelhead Restoration and Management Plan for California. The Resource Agency, State of California, Department of Fish and Game. 234 pp.
- U. S. Fish and Wildlife Service. 1995. Working Paper on restoration needs: habitat restoration actions to double natural production of anadromous fish in the Central Valley of California. Volume 1, 2 and 3. May 9, 1995. Prepared for the U. S. Fish and Wildlife Service under the direction of the Anadromous Fish Restoration Program Core Group. Stockton, California.
- Garcia, A. 1989. The impacts of squawfish predation on juvenile chinook salmon at Red Bluff Diversion Dam and other locations in the Sacramento River. U. S. Fish and Wildlife Service, Report Number AFF-FAO-89-05, Northern Central Valley Fishery Resource Office, Red Bluff, California.
- Vondracek, B., and P. B. Moyle. 1982. The biology of the Sacramento squawfish *Ptychocheilus grandis* and predation on juvenile salmon *Oncorhynchus tshawytscha* in the Sacramento River. Annual Report to the California Department of Water Resources, Sacramento, California.
- Vondracek, B., and P. B. Moyle. 1983. Squawfish predation at Red Bluff Diversion Dam. Report to the California Department of Water Resources, Sacramento, California.

IV.

Budget Costs

- a. **Budget Costs.**—Table 1 has project costs for Task 1, which is an expansion of the existing Reclamation evaluation of the RPP at RBDD project which extends through FY '98; and annual costs for Task 2, which continues a full scale project for FY '99 and beyond. This project is envisioned and multiyear and would continue as long as the data is needed by managers and researchers working on restoration projects in the basin. This project would require no major capitol expenditures for equipment, using existing boats, trucks and electro-fishing gear.

Table 1.—Budgets to complete Task 1 (3 days per month sampling) and Task 2 (4 days per month sampling). This project would use existing boats and electro-fishing gear.

Project Phase and Task	Direct Labor Hours	Direct Salary and Benefits	Service Contracts	Material and Acquisition Contracts	Misc. and other Direct Costs	Overhead Labor (General, Administration and fee)	Total Costs
Task 1, 3 da/mo.	7,200	\$225,000	\$0	\$0	\$17,000	\$45,980	\$287,980
Task 2, 4 da/mo	9,600	\$300,000	\$0	\$0	\$23,000	\$57,000	\$380,000

CALFED funding is needed to supplement current funding from the Reclamation. Future funding will be required at completion of RPP evaluations in FY '98. Funding could potentially be shared between AFRP and CAMP programs, if and when that funding becomes available.

- b. **Schedules and Milestones.**—Field work for the pilot program began in July 1994 and extended through summer 1995. Analyses for the pilot year and a progress report will be available summer of 1997. Work will be continuous through FY '98.
- c. **Third Party Impacts.**—None.

V. Applicant Qualifications.—The Northern Central Valley Fish and Wildlife Office (NCVFWO) was established in 1978 as part of the U.S. Fish and Wildlife Service's (Service) responsibility to facilitate restoration of Pacific salmonids. The construction and operation of dams and water diversion projects and the subsequent degradation and loss of habitat have been the primary contributors to the decline in all anadromous salmonid stocks in the upper Sacramento River. Specific goals of the NCVFWO are to: 1) Stabilize or increase the runs of anadromous salmonids in the Sacramento River system, 2) Improve the effectiveness of federal fish propagation facilities in California and Nevada, 3) Protect and restore the productivity of natural habitats in the Sacramento River system, and 4) Continue development of information and strategies for protecting the natural habitats of the Sacramento River system as migration routes, spawning areas, and nursery areas for anadromous salmonids. The staff consists of 30 biologists and support staff, most of whom are already working in the upper Sacramento River.

Project Personnel and Qualifications

James G. Smith.—Mr. Smith's position is with the U.S. Fish and Wildlife Service as Project Leader at the Northern Central Valley Fish and Wildlife Office at Red Bluff where he is responsible for the management of a 30 person office. Mr. Smith received a B. S. degree with major in fishery biology from Humboldt State University in 1975 and did post-graduate studies at the same from 1976-79. He has worked as a professional biologist for 18 years in Oregon, Washington and California. For the past fourteen years he has been personally involved with numerous fishery studies involving salmon including fish passage investigations at RBDD, monitoring downstream migrations of juvenile salmonids, hatchery evaluation efforts at Coleman NFH, and salmon spawning gravel restoration evaluation activities. The office has responsibilities that include identifying and defining factors affecting the abundance and survival of anadromous salmonids produced in the Sacramento River Basin, California. Mr. Smith works on a daily basis with numerous federal, state, and private entities in developing actions and programs for restoring, conserving, and enhancing anadromous salmonids in the upper Sacramento River.

Richard R. Johnson.—Mr. Johnson is a 1976 graduate from Humboldt State University (B.S.), with major in fishery biology. He did post-graduate work at the University of Alaska, Fairbanks from 1990-91. He has been a professional fishery biologist for 19 years. Mr. Johnson has experience as a commercial salmon fisherman in California, and in commercial and federal hatcheries in California, Ohio, and Michigan. He spent 7 years as a management biologist in Fairbanks, Alaska working with lake trout, Arctic char, northern pike and various whitefish species, before arriving at the Service's Northern Central Valley Fish and Wildlife Office in Red Bluff, California 6 years ago, where he is the Deputy Project Leader.

Craig Martin.—Mr. Martin is a 1991 graduate from West Virginia University (B.S., wildlife management with fisheries emphasis) and a 1995 graduate from Oklahoma State University (M.S.; fisheries biology). He started his career working in West Virginia and Pennsylvania as a fisheries technician for West Virginia University and West Virginia Department of Natural Resources. While pursuing his Master's degree, he worked for the Oklahoma Cooperative Fish and Wildlife Research Unit evaluating native smallmouth bass stream fisheries. Mr. Martin has been with the U.S. Fish and Wildlife Service for 2 years and is currently a fisheries biologist with the Service's Red Bluff Office.

VI. Compliance with Standard Terms and Conditions.—We will provide the appropriate documents and signatures regarding Submittal/Compliance of Standard Terms and Conditions, prior to signing final contracts, as indicated in the Table D-1 matrix of Standard Clauses/Proposal Request for a public agency proposing a Group 3 (Services) application type.